

WHAT IS CLAIMED IS:

1. A flow control device comprising:  
an inlet;  
an outlet in fluid communication with the inlet;  
a pressure loss element between the inlet and outlet in fluid communication with the inlet and outlet;  
a first pressure sensor located upstream from the pressure loss element configured to measure a first pressure of a fluid flowing through the flow control device;  
a second pressure sensor located downstream from the pressure loss element, configured to measure a second pressure of the fluid flowing through the flow control device; and  
a controller coupled to the first pressure sensor and the second pressure sensor, the controller configured to:  
operate according to a first mode of operation, wherein during the first mode of operation the controller generates a valve control signal based on a differential between the first pressure and the second pressure;  
operate according to a second mode of operation, wherein during the second mode of operation the controller generates the valve control signal based on a measured pressure at a particular pressure sensor; and  
switch between the first mode of operation and the second mode of operation according to a predefined parameter.
2. The flow control device of Claim 1, further comprising a valve responsive to the valve control signal located between the inlet and the outlet and coupled to the controller.

3. The flow control device of Claim 1, wherein, in the second mode of operation, the controller generates the valve control signal based on the measured pressure at the upstream pressure sensor.

4. The flow control device of Claim 1, wherein, in the second mode of operation, the controller generates the valve control signal based on the measured pressure at the downstream pressure sensor.

5. The flow control device of Claim 1, wherein the predefined parameter comprises a pressure differential threshold.

6. The flow control device of Claim 5, wherein the controller is further configured to:

determine the differential between the first pressure and the second pressure;

compare the differential to the pressure differential threshold; and

operate according to the first mode of operation if the differential between the first pressure and the second pressure is greater than the pressure differential threshold.

7. The flow control device of Claim 5, wherein the controller is further configured to:

determine the differential between the first pressure and the second pressure;

compare the differential to the pressure differential threshold; and

operate according to the second mode of operation if the differential between the first pressure and the second pressure is less than the pressure differential threshold.

8. The flow control device of Claim 5, wherein the controller is further configured to calculate the pressure differential threshold based on the differential between the first pressure and the second pressure, a supply pressure and a valve position.

9. The flow control device of Claim 1, wherein the controller is further configured to:  
monitor the first or second sensor for a fluctuation; and  
if the fluctuation is greater than a predetermined amount, generate an alarm.

10. The flow control device of Claim 1, wherein the controller is further configured to:  
monitor a valve for a change in valve position; and  
if the change in valve position is greater than a predetermined amount, generate an alarm.

11. A computer program product comprising:  
a set of computer instructions stored on at least one  
computer readable medium executable by at least one processor  
to:  
receive a measurement of a first pressure;  
receive a measurement of a second pressure;  
operate according to a first mode of operation, wherein the  
computer instructions are executable to calculate a flow rate  
based on a differential between the first pressure and the  
second pressure;  
operate according to a second mode of operation, wherein  
the computer instructions are operable to calculate the flow  
rate based on a measured pressure at a particular pressure  
sensor; and  
switch between the first mode of operation and the second  
mode of operation according to a predefined parameter.

12. The computer program product of Claim 11, wherein, in  
the second mode of operation, the set of computer instructions  
are executable to calculate the flow rate based on the  
measurement of the second pressure received from a downstream  
pressure sensor.

13. The computer program product of Claim 11, wherein, in  
the second mode of operation, the set of computer instructions  
are executable to calculate the flow rate from the measurement  
of the first pressure from an upstream pressure sensor.

14. The computer program product of Claim 11, wherein the predefined parameter comprises a pressure differential threshold.

15. The computer program product of Claim 14, wherein the computer instructions are executable to:

determine the differential between the first pressure and the second pressure;

compare the differential to the pressure differential threshold; and

operate according to the first mode of operation if the differential between the first pressure and the second pressure is greater than the pressure differential threshold.

16. The computer program product of Claim 14, wherein the set of computer instructions are executable to:

determine the differential between the first pressure and the second pressure;

compare the differential to the pressure differential threshold; and

operate according to the second mode of operation if the differential between the first pressure and the second pressure is less than the pressure differential threshold.

17. The computer program product of Claim 14, wherein the set of computer instructions are executable to calculate the pressure differential threshold based on the differential between the first pressure and the second pressure, a supply pressure and a valve position.

18. The computer program product of Claim 11, wherein the set of computer instructions are further executable to:  
monitor a pressure sensor for a fluctuation; and  
if the fluctuation is greater than a predetermined amount, generate an alarm.

19. The computer program product of Claim 11, wherein the set of computer instructions are further executable to:  
monitor a valve for a change in valve position; and  
if the change in valve position is greater than a predetermined amount, generate an alarm.

20. A method of controlling flow comprising:
- measuring a first pressure;
  - measuring a second pressure;
  - in a first mode of operation, generating a valve control signal based on a differential between the first pressure and the second pressure;
  - in a second mode of operation, generating the valve control signal based on a measured pressure at a particular pressure sensor; and
  - switching between the first mode of operation and the second mode of operation according to a predefined parameter.
21. The method of Claim 20, further comprising opening or closing a valve responsive to the valve control signal.
22. The method of Claim 20, wherein generating the valve control signal based on the measured pressure at a particular pressure sensor comprises generating the valve control signal based on the measured pressure at a upstream pressure sensor.
23. The method of Claim 20, wherein generating the valve control signal based on the measured pressure at a particular pressure sensor comprises generating the valve control signal based on the measured pressure at a downstream pressure sensor,
24. The method of Claim 20, wherein the predefined parameter comprises a pressure differential threshold.

25. The method of Claim 24, further comprising:  
determining the differential between the first pressure and the second pressure;  
comparing the differential to the pressure differential threshold; and  
operating according to the first mode of operation if the differential between the first pressure and the second pressure is greater than the pressure differential threshold.

26. The method of Claim 24, further comprising:  
determining the differential between the first pressure and the second pressure;  
comparing the differential to the pressure differential threshold; and  
operating according to the second mode of operation if the differential between the first pressure and the second pressure is less than the pressure differential threshold.

27. The method of Claim 24, further comprising calculating the pressure differential threshold based on the differential between the first pressure and the second pressure, a supply pressure and a valve position.

28. Method of Claim 20, further comprising:  
monitoring the second sensor for a fluctuation; and  
if the fluctuation is greater than a predetermined amount, generating an alarm.

29. The method of Claim 20, further comprising:



monitoring a valve position for a change in valve position;  
and

if the change in valve position is greater than a  
predetermined amount, generating an alarm.

30. A computer program product comprising a set of computer instructions stored on at least one computer readable medium, the set of computer instructions executable by at least one processor to:

- receive pressure measurements from a sensor;
- monitor the pressure measurements for a fluctuation;
- compare the fluctuation to a predetermined limit;
- if the fluctuation is greater than the predetermined limit, generate an alarm.

31. The computer program product of Claim 30, wherein the sensor is a sensor downstream of a pressure loss element.

32. The computer program product of Claim 30, wherein the sensor is a sensor downstream of a valve.

33. A computer program product comprising a set of computer instructions stored on at least one computer readable medium, the set of computer instructions executable by at least one processor to:

- receive an upstream pressure from an upstream sensor located upstream of a pressure loss element;
- receive a downstream pressure measurement from a downstream of the pressure loss element;
- monitor a valve for a valve position;
- determine a differential between the measured pressures;
- and
- determine a control resolution based on the differential between the measured pressures, the valve position and a valve resolution.

34. The computer program product of Claim 33, wherein the set of computer instructions are further executable to:

- determine if the control resolution is acceptable;
- if the control resolution is not acceptable, generate a signal to cause the valve to change the valve position to a new valve position that will create a larger differential;
- receive a new upstream pressure;
- receive a new downstream pressure;
- determine the larger differential based on the new upstream pressure and the new downstream pressure; and
- determine a new control resolution based on the larger differential, the new valve position and the valve resolution.

35. The computer program product of Claim 33, wherein the set of computer instructions are further executable to:

determine if the control resolution is acceptable;  
if the control resolution is acceptable, select the  
differential as a differential pressure threshold.

36. The computer program product of Claim 33, wherein the computer instructions are further executable to switch between a first mode of operation and a second mode of operation based on comparisons subsequent differentials to the differential pressure threshold.

37. The computer program product of Claim 33, wherein the set of computer instructions are executable to determine the control resolution by:

    multiplying the differential as a percentage of a full scale pressure by the valve position as a percentage of how much the valve is open to generate; and

    multiplying by the valve resolution.

38. A method comprising:  
receiving pressure measurements from a sensor;  
monitoring the pressure measurements for a fluctuation;  
comparing the fluctuation to a predetermined limit;  
if the fluctuation is greater than the predetermined limit,  
generating an alarm.

39. The computer program product of Claim 38, wherein the  
sensor is a sensor downstream of a pressure loss element.

40. The computer program product of Claim 38, wherein the  
sensor is a sensor downstream of a valve.

41. A computer program product comprising:  
a set of computer instructions stored on at least one  
computer readable medium executable by at least one processor  
to:  
receive a measurement of a first pressure;  
receive a measurement of a second pressure;  
operate according to a first mode of operation, wherein the  
computer instructions are executable to generate a valve control  
signal based on a differential between the first pressure and  
the second pressure;  
operate according to a second mode of operation, wherein  
the computer instructions are operable to generate the valve  
control signal based on a measured pressure at a particular  
pressure sensor; and  
switch between the first mode of operation and the second  
mode of operation according to a predefined parameter.

42. The computer program product of Claim 41, wherein, in  
the second mode of operation, the set of computer instructions  
are executable to generate the valve control signal based on the  
measurement of the second pressure received from a downstream  
pressure sensor.

43. The computer program product of Claim 41, wherein, in  
the second mode of operation, the set of computer instructions  
are executable to generate the valve control signal from the  
measurement of the first pressure from an upstream pressure  
sensor.

44. The computer program product of Claim 41, wherein the predefined parameter comprises a pressure differential threshold.

45. The computer program product of Claim 44, wherein the computer instructions are executable to:

determine the differential between the first pressure and the second pressure;

compare the differential to the pressure differential threshold; and

operate according to the first mode of operation if the differential between the first pressure and the second pressure is greater than the pressure differential threshold.

46. The computer program product of Claim 44, wherein the set of computer instructions are executable to:

determine the differential between the first pressure and the second pressure;

compare the differential to the pressure differential threshold; and

operate according to the second mode of operation if the differential between the first pressure and the second pressure is less than the pressure differential threshold.

47. The computer program product of Claim 13, wherein the set of computer instructions are executable to calculate the pressure differential threshold based on the differential between the first pressure and the second pressure, a supply pressure and a valve position.

48. The computer program product of Claim 41, wherein the set of computer instructions are further executable to:  
monitor a pressure sensor for a fluctuation; and  
if the fluctuation is greater than a predetermined amount, generate an alarm.

49. The computer program product of Claim 41, wherein the set of computer instructions are further executable to:  
monitor a valve for a change in valve position; and  
if the change in valve position is greater than a predetermined amount, generate an alarm.



50. A method of monitoring flow comprising:  
    measuring a first pressure;  
    measuring a second pressure;  
    in a first mode of operation, determining a flow rate based on a differential between the first pressure and the second pressure;  
    in a second mode of operation, determining the flow rate based on a measured pressure at a particular pressure sensor; and  
    switching between the first mode of operation and the second mode of operation according to a predefined parameter.

51. The method of Claim 50, wherein determining the flow rate based on the measured pressure at a particular pressure sensor comprises determining the flow rate based on the measured pressure at a upstream pressure sensor.

52. The method of Claim 50, wherein determining the flow rate based on the measured pressure at a particular pressure sensor comprises determining the flow rate based on the measured pressure at a downstream pressure sensor,

53. The method of Claim 50, wherein the predefined parameter comprises a pressure differential threshold.

54. The method of Claim 53, further comprising:

determining the differential between the first pressure and the second pressure;

comparing the differential to the pressure differential threshold; and

operating according to the first mode of operation if the differential between the first pressure and the second pressure is greater than the pressure differential threshold.

55. The method of Claim 53, further comprising:

determining the differential between the first pressure and the second pressure;

comparing the differential to the pressure differential threshold; and

operating according to the second mode of operation if the differential between the first pressure and the second pressure is less than the pressure differential threshold.